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INDUSTRIAL WASTE PRACTICE--SOME THOUGHTS FOR SANITARY ENGINEERS

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SANITARY ENGINEERING DIVISION

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INDUSTRIAL WASTE PRACTICE—SOME THOUGHTS FOR SANITARY ENGINEERS

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SYNOPSIS

With the increasing importance of industrial waste control, reduction and treatment, sanitary engineers are faced with the normal growing pains of a new specialty. This report, which is an attempt to record the most significant thoughts expressed at the discussion which was held at the 1954 Annual Meeting in New York City, includes discussions on the need for thorough preliminary investigation and reporting on industrial waste problems, for responsible recommendations from engineers on sound waste reduction and control measures, for the consideration of treatment facilities only as a last resort in the solution of a waste problem, for better professional standards for retaining sanitary engineers for industrial waste services, and for improvement in the procedures by which industrial management retains engineers for such work. Other items are: The sanitary engineer as a coordinator of scientific and engineering skills; process modifications as a means to lessen waste loads; the part plant personnel must play in the investigation and correction of waste abuses; and how equipment sales companies fit into this picture.

Background

As an outgrowth of the widespread discussions on the professional problems facing sanitary engineers in industrial waste practice, a forum, "Sanitary Engineers in Industrial Waste Treatment," was held at the Sanitary Engineering Division sessions of the Annual Meeting of the Society, Oct. 19, 1954 in New York City. The discussions were unprepared and as such they represented the direct thinking of the forum's participants and the audience.

The ideas and opinions and statements expressed at the forum are summarized in this report. They are published to stimulate thinking and discussion, and it is hoped to encourage improved professional relationships in industrial waste practice.

Participants

The forum was organized with these engineers: Roy F. Weston, sanitary engineer, Atlantic Refining Co.; George Dreher, chemical engineer, Jones & Laughlin Steel Co., Pittsburgh; B. W. Dickerson, sanitary engineer, Hercules Powder Co., Wilmington, Del; Dr. A. J. Fischer, research and development engineer, The Dorr Co., Stamford, Conn.; William S. Wise, director, State

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Water Commission, Hartford, Conn.; M. H. Klegerman, consulting engineer, New York City; E. B. Cobb, consulting engineer, Metcalf and Eddy, Boston; and John E. Kinney, sanitary engineering consultant and forum leader, Ann Arbor, Michigan.

Those in the audience who contributed to this discussion were: T. R. Camp, consulting engineer, Boston; Richard Hazen, consulting engineer, New York City; Earnest Boyce, Professor of Civil Engineering, University of Michigan; Ray Lawrence, consulting engineer, Black and Veatch, Kansas City; Prof. Daniel A. Okun, School of Public Health, University of North Carolina, Chapel Hill; Prof. Nelson Nemerow, Dept. of Civil Engineering, N. C. State College, Raleigh; and George E. Symons, Technical Consultant and Editor, Larchmont, New York.

To guide the discussions and to provide answers and explanations to some of the most-often-asked questions, the Forum was carried out on the basis of a series of stated questions to which the participants and the audience gave their answers and reactions. This report is based on the same questions and summarized replies that were given.

QUESTION: IN WHAT RESPECTS DOES AN INDUSTRIAL WASTE PROBLEM DIFFER FROM A MUNICIPAL SEWAGE PROBLEM?

There is a difference in design but the objectives are similar. Municipal plants with few exceptions handle wastes of similar physical and chemical characteristics; the volumes and concentrations can be measured as well as anticipated with reasonable accuracy. But industrial wastes vary in volume and concentration with changes in the production schedule.

Municipal treatment plants are designed for about a twenty-year period of normal operation. Basic operations in industry are subject to daily changes with wide variations in the industrial waste load; industrial waste plants can be made obsolete in two to five years as a result of process developments.

Municipalities generally require complete installations for the treatment of waste water. Industries are served by specific units for controlling and treating process wastes.

Municipal sewage plants are usually remote from all other activities; sewage treatment is often a step-child in municipal affairs. Treatment of industrial wastes is a step in process and is a part of plant maintenance.

Municipal plants accept the wastes discharged to the sewers. Industrial waste treatment is tied back into process operations where a change may eliminate, reduce or increase the waste load.

Municipal sewage wastes are generally comparable on the basis of solids and biochemical oxygen demand. But industrial wastes may have neither but still be objectionable because of color, toxicity, pH, temperature, or odor—and industrial wastes may have changing characteristics.

The objective of municipal and industrial waste treatment is the same—protection of subsequent water uses. This cannot be accomplished by rigid adherence to a uniformity of plant design. The requirements of each stream must be known and understood; the sanitary engineer designs a municipal treatment plant to preserve certain conditions in a stream; the same approach should be utilized in developing treatment designs or waste control programs for industrial wastes, but the rigid application of sewage design principles to industrial wastes is neither sound engineering practice,—or economical.

The sanitary engineer is a 'natural' to handle industrial waste matters because of similarities to sewage problems; the differences, however, are significant. The sanitary engineer appears to be leading the field in industrial waste practice but his lead is being threatened by those with greater flexibility and industrial processing background. Change is the order of the day in industry whereas in municipal practice change is frowned upon and often feared.

The consultant in municipal practice is a referee but in industrial waste work he is a coach. In industry reduction of waste loads may be far more advisable than construction of an expensive treatment facility. The consultant has to gear his thinking to cost reduction instead of design of treatment facilities that may be made obsolete overnight, to waste control and reduction instead of waste treatment, to new designs and processes when treatment is imperative, to a five-year life instead of a twenty-year life.

The sanitary engineer has an opportunity to be the leader in industrial waste practice because any type of waste reduction service depends upon preservation of desirable conditions in the stream, a concept he is trained to think in. His challenge is to make sure that the desirable stream conditions will be maintained by means of the type of cost-conscious thinking and the processes that industry likes and uses. The rigidity of practice as exemplified by municipal projects has to be replaced by a highly flexible approach wherein novelty, cost savings and results command a high premium.

QUESTION: ARE NOT SANITARY ENGINEERS PRIMARILY CONCERNED WITH WATER AND SEWAGE TREATMENT? WHY SHOULD THEY BE CONCERNED WITH INDUSTRIAL WASTE TREATMENT—A CHEMICAL AND PHYSICAL PROCESS?

Industrial wastes degrade public and industrial water supplies, interfere with sewage plant operation, affect biological life in the stream as well as the stream's self-purification capacity, and require treatment only because of their subsequent effects on water uses. And the degree of treatment required is that needed to protect downstream uses. Designing the treatment is a logical step in going from the stream back to the manufacturing plant.

Industrial representatives on the forum pointed out that the principles that apply to the treatment of water and sewage do not always hold for industrial wastes. As a step in process, waste treatment facilities should be integrated with manufacturing operations. This is a role for the chemical engineer, chemist, or process operating personnel.

The chemical engineer is well-trained in processing problems; he is much better qualified within the plant than the sanitary engineer. This difference in approach can spell the difference between having and not having a pollution problem.

When the chemical engineer works with processing his attention is drawn to trouble spots; his approach is governed by costs, both of which considerations determine remedial measures.

The sanitary engineer, on the other hand, has a basic concept of stream pollution abatement but his handicap is his lack of a concept of the effect of industrial wastes on a stream,—or the possibilities of a change in process.

The sanitary engineer's function (and opportunity) is one of leadership: coordinating the abatement program and organizing an approach to its solution. This approach to pollution abatement should utilize analysis, research,

process control, chemistry, biology,—in addition to the accepted specialties—structural, electrical, mechanical, and construction.

The growing recognition of the complexity of some of the industrial waste problems is making it apparent that the sanitary engineer's job is one of coordination of all available engineering and scientific skills. No single specialist engineer can be familiar with all the aspects of a problem as well as with all avenues of approach to its solution.

The consultant needs all the information and assistance he can muster when he tackles an industrial waste problem, the industrial representatives pointed out. They added: "more consultants should adopt the philosophy prevalent in industry that—when a man who makes a mistake and who has not taken the trouble to get expert advice has the boom lowered on him in a hurry. If he takes the time and gets advice and hears his advisors out, then he is not criticized."

The industry members of the panel expressed the feeling that the sanitary engineering consultant is needed by industry to guide its public relations. The era of denying any and all ill effects from industrial wastes is over. However, industry is skeptical about sanitary engineers; they must sell themselves to management and plant personnel.

Industry does not hold with some of the standards that have been set by regulatory agencies, and frequently there are no applicable standards. Industry would like consultants to study the streams and to recommend standards or waste-load-discharge requirements. When this is properly done, the industrial client has the assurance that there will be no more treatment to be paid for than is absolutely necessary. Industry also benefits from this type of consulting because the consultant serves as a referee and brings in impartial, unbiased viewpoints.

The consultants argued that it is not practical for an independent engineer to go into industry and make stream studies and formulate waste-load requirements. They feel that some agency must spell out the degree of treatment or waste reduction needed.

The industry and regulatory members of the forum disagreed with this philosophy; they want consultants to industry to perform-investigative and evaluation services in addition to those of merely designing the treatment plant to meet specific requirements. They also want the consultant to evaluate treatment requirements before doing design work; they want an impartial responsible appraisal of the degree of treatment that has been established by some agency.

QUESTION: DESIGN OF MUNICIPAL SEWAGE TREATMENT PLANTS IS USUALLY LIMITED TO PRIMARY, INTERMEDIATE OR 'COMPLETE' REDUCTION IN BIOCHEMICAL OXYGEN DEMAND AND SUSPENDED SOLIDS. STATE REQUIREMENTS SOMETIMES REFER TO 'EQUIVALENT' TREATMENT FOR INDUSTRIAL WASTES. IS THIS REALISTIC AND PRACTICAL?

The states use the term 'equivalent' treatment to call for industries and municipalities each to provide what is considered the same amount of treatment. But this practice considers all wastes to have the same effect and does not consider a difference that actually exists: the same type of treatment for all wastes will not accomplish the same degree of treatment.

The panel members agreed with one commentator who noted that 'equivalent' treatment is a good hedge for the states but it causes difficulty rather than assisting pollution abatement. Many industries do not want to abate their pollution until municipalities get their sewage treatment programs underway, and calling for 'equivalent' treatment is not going to change that attitude. As an example, he pointed out that there is no common basis for comparing pickle liquor and organic wastes. He also questioned that comparability of all organic wastes on a BOD basis. There are, in his opinion, several characteristics that should be considered for each individual waste and that the degree of treatment can only be determined after such consideration. He added that Connecticut does not use the 'equivalent' treatment policy.

Standards were also discussed and the consensus appeared to be that they should be considered only in terms of what the regulatory agency was thinking about,—and that discretion was to be used in their application.

It was generally agreed that the regulatory agency job in any state is a large order and that there must be general requirements to get a pollution abatement program underway.

The small engineering staffs of the states make it impossible to devote adequate time and attention to each disposal problem; hence there is an opportunity for the consultant to provide an urgently needed service in formulating industrial waste control and treatment needs.

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QUESTION: POLLUTION CONTROL AGENCY PERSONNEL ACTUALLY PRACTICE CONSULTING ENGINEERING BY ADVISING INDUSTRY ON ITS PROBLEMS. RECOMMENDATIONS AND APPROVAL ARE GIVEN BY THE SAME PERSON AND AGENCY. IS THIS PROPER?

Industry members of the forum denied that they were bypassing consultants when they went to regulatory agency personnel for advice. They pointed out that industry seeks all of the data that it can get and contacts all possible sources of information. The industry representatives stated that they were merely putting into practice the concept that each waste problem had its own personality and as such should be fully explored rather than typed before investigation.

No objection was expressed to industry collecting all available data on a particular treatment problem but it was suggested that the consultant's proper role would be to assist in the evaluation of that data and in its utilization and presentation to the state control agency.

Industry's aim, it was admitted, is to provide a minimum of necessary treatment and hence to incur a minimum of capital and operating expense. To do this, it is exploring all possibilities, particularly when there is an opportunity or a need for a new treatment procedure for a particular problem.

The developmental, exploratory waste problems are often avoided by the responsible consultant because of a lack of knowledge and experience coupled with the need for extensive research. Too often, the unqualified, 'would-be' consultant overlooks these essential facets of industrial waste practice in his headlong rush to get a job.

One of the commentators mentioned the problems involved in having a state agency approve plans that were developed with the assistance of that agency's personnel. It was emphasized that in most states approval is given with the expressed provision that the waste plant provide the degree of

treatment stipulated; in this case the state assumes no responsibility or recognizes its part in developing the design.

Under the Connecticut law, the State Water Commission is required to assist industry with solutions to their waste problems. This activity has resulted in comparable estimates of cost of waste control or treatment facilities for those submitted by consultants. In one instance a consultant estimated the cost of treatment facilities at \$100,000 which was rejected by industrial management as prohibitive. The proposal worked out in cooperation with the State Water Commission actually cost the company \$10,000.

Under the Connecticut law, it is recognized that inasmuch as industry pays taxes which support the state agency they can expect some assistance in the form of technical services.

The panelists agreed that this situation does not prevent the competent consultant from providing a much needed service to industry. There is ample opportunity for the consultant to serve as an effective coordinator as well as an 'advocate' for industry.

QUESTION: EQUIPMENT SALES COMPANIES ADVERTISE FREE CONSULTING ENGINEERING SERVICES ON WASTE PROBLEMS. HOW DOES THIS PRACTICE TIE IN WITH GOOD CONSULTING PRACTICE?

One equipment company representative stated that any company advertising free consulting service is misleading its readers. Information is provided on the products being sold and this does not constitute impartial service provided by the competent consultant.

Equipment companies, he pointed out, spend considerable time and large amounts of money to develop equipment for handling different types of industrial wastes, a financial and developmental operation that is beyond the capability of most consultants to furnish. The consultants as well as industries have these equipment-advice services at their command. The equipment companies, however, depend on consultants for satisfactory structural and hydraulic design for the installation of their treatment devices.

Both the industrialist and the consultant are guilty, one speaker said, of a common error; they are prone to purchase one type of equipment for all problems. The consultant's contribution should be in the appraisal of the problem and the proper selection of equipment to do the job that is required.

Equipment companies, a representative added, give guarantees which no consultant is prepared to do for his designs.

Industry, moreover, is accustomed to contacting manufacturers with specifications for equipment purportedly designed for a particular function. This attitude carries over into the industrial waste field.

It was pointed out that there is a need for a proper evaluation of waste characteristics and volumes discharged, by a competent engineer, before proposals for treatment equipment are entertained. When this is done, the problem may be minimized, and it provides a sound overall background for the selection of the necessary equipment.

An illustration was given of two types of practice: That of a consultant who overplays his hand by 'supervising' the development of a treatment program wherein most of the ideas and suggestions originate with the company with the waste problem or with the company selling equipment. When the final design is ready, this 'consultant' has been educated at the company's expense.

This procedure was compared to the responsible practice of the qualified consultant who provides proper and effective supervision of the waste investigation program and coordination and evaluation of several possible solutions, all on the basis of engineering economics, with final responsible recommendations to the industry. In this procedure, methods of treatment should be evaluated in each plant in terms of space available, cost of the installation and maintenance, personnel requirements, chemicals, power, odor, etc. This, it was suggested, is truly the work of the responsible consultant.

QUESTION: TWO COMMON APPROACHES OF CONSULTANTS TO INDUSTRY ARE: THE FEES WILL BE CHARGED ON THE BASIS OF PERCENTAGE OF COST OR, HOW MUCH IS IT WORTH TO THE COMPANY TO DELAY DOING ANYTHING? WHAT APPROACH SHOULD BE USED?

When the consultant talks about a percentage of cost of construction of a treatment plant, management knows that the consultant probably has only one vision—a treatment plant. If a treatment plant is the sole objective, the possibilities of reducing wastes by good housekeeping, process changes, water conservation and water reuse will not receive proper engineering consideration. And exploration of these possibilities may reduce the size of the treatment plant materially (with important savings to industry).

On the other hand, if the prospective consultant talks about stalling tactics—delay of pollution abatement programs, then he fails to face the hard facts. The majority of industry is reportedly recognizing the need for waste reduction or waste treatment. But industry is fully aware of the time required to develop sound pollution abatement programs. Hurried decisions either at the beginning or after a period of unwise delay may incur undue expense for industry. So said the industry representatives.

It must be recognized that both of these approaches to industry are being employed; but an additional element must be brought into play: the use of the per diem contract to encourage proper investigation.

Industry representatives argued that the consultant should be the leader in developing an appreciation of the value of preliminary investigation with a policy-guiding report submitted prior to the design of any treatment facilities. These preliminaries should be handled on a per diem basis and include a complete survey of the plant's wastes, measurement of concentrations and flows, a review of plant housekeeping practices, the possibilities of educating plant personnel in controlling and avoiding unnecessary waste discharges, and investigation of process changes to reduce waste loads. This type of program, industry contends, should be developed and reviewed with management and admitting to the need for developing some of the solutions in cooperation with plant personnel. It is imperative, they feel, that the consultant in his report (1) Outline all of the questions to be answered; and (2) List the policy decisions that must be made for a successful waste control program.

Such a preliminary investigation program may cost a considerable amount of money; but management must be made aware of the potential in savings that can be uncovered by a thorough investigation and evaluation of the several possible solutions by economic comparison. Management, it was conceded, will have to be sold on the value of preliminary investigation and report.

Buying of a package plan (preconceived design) to solve a waste problem was severely criticized as poor engineering and poor economics.

Consultants, it was suggested, would do well to discourage the use of the lump sum fee basis for industrial waste services, particularly where a preliminary survey has not been made. And industry, with its eye always on costs, should be willing to pay adequate per diem fees to the competent consultant so that the consultant does not pass over or minimize the possibilities of reducing waste treatment plant costs. Industry should be made to recognize that the services of a consulting engineer are similar to those provided by a lawyer or a physician, that they are creative, that they are not a product to be bought at the lowest possible cost. Sometimes engineers in industry seem to forget that they are a part of the engineering profession by harping on low cost for engineering services to the exclusion of professional factors such as reputation, experience, competency and qualified personnel.

QUESTION: WITH THE ACCENT ON WASTE DISPOSAL MANY CONSULTING CIVIL AND CHEMICAL ENGINEERS RECOGNIZE A POTENTIALLY LUCRATIVE FIELD AND HAVE 'ADVERTISED' THEIR SERVICES. HOW DOES A COMPANY DETERMINE COMPETENCY?

Industry should investigate an engineer's background, organization, reputation and activity in the industrial waste control field. They should check up specifically on his attitude toward (1) preliminary investigation, and (2) coordinating in-plant surveys before designing treatment facilities.

It was pointed out from the floor that there is a movement within the profession to certify sanitary engineers but it was noted that certification was not necessarily embracing sanitary engineers in the industrial waste field. This discussion underscored the need for the engineering profession to do its own policing as well as the need for an industrial waste representative on the proposed specialty board for certification.

While industry is to blame for the manner in which consulting engineers are often retained, the belief was expressed that it would be asking too much to suggest that industry initiate a reform in this procedure.

Someone remarked that the term 'insulting engineer' is often heard applied to the consultant in this field and it is not in jest! This stands as a serious charge and the forum members thought that it indicated a need for leadership in this field by the Sanitary Engineering Division.

One engineer commented sagely: The only solution is for the consultant to develop the respect that is his due. The main difficulty lies with those 'marginal' engineers who do not recognize their own limitations, persist in trying to handle any and all waste problems which are beyond their capabilities, and earn a black eye for the profession as a whole through their failure to perform in a professional manner.

The opinions were offered by several speakers that this field is a new area of engineering practice and that there are no experts in it. The expert was cynically defined as a man who had a talking knowledge of the subject for two years. And over the course of time those who make serious mistakes will be out of business. Fewer industrial waste consultants are expected in the field ten years from now. Such a natural mortality will not solve the problem, however, because of the influx of new faces each year. This remains an engineering profession challenge because each engineer who practices in the industrial

waste field without the competence and integrity required becomes a reflection on the profession as a whole.

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QUESTION: WHEN A COMPANY RECEIVES ORDERS TO ABATE POLLUTION, DOES IT MEAN THAT A TREATMENT PLANT MUST BE BUILT?

Industry considers waste treatment as a step in process. Depending on the degree of reduction of the waste load ordered by the state, a change in plant operation may achieve the desired results. The industrial representatives commented that this fact should be appreciated by regulatory agencies as well as consultants. Industry objects to having treatment plants designed without a check on the possible reduction or modification of waste loads; the objective being to reduce the waste load, not just to construct treatment plants.

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QUESTION: IF THERE ARE PROCESS CHANGES THAT WILL REDUCE WASTE DISCHARGES, THEN WHY DON'T ALL COMPANIES EMPLOY THEM?

In many instances a company will not divulge changes in process that produce reductions in the waste load. There is a wide divergence among industry men as to whether changes in plant operations should be revealed to state agencies, or others. One state representative felt that if a consultant could show the difference in load discharged to a stream after such a process modification, then there was no reason to divulge plant operation secrets; the results counted!

The consultants pointed out that changes in processes are not always applicable at all plants even in the same industry. Limitations such as available space, economics of process changes compared to treatment costs, and variations in process operations within the same industry have controlling effects on the decision to be made. The size of the treatment plant is affected by the volume of water used,—and reduction in water consumption is a process modification.

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QUESTION: MUST SUGGESTIONS FOR PROCESS MODIFICATIONS COME ONLY FROM PLANT PERSONNEL, OR CAN A CONSULTANT BE EXPECTED TO SUGGEST CHANGES?

Suggestions for process modifications generally require an intimate knowledge of the unit processes within the plant. It was agreed that the consultant would seldom have the qualifications to make these recommendations but that he is well-qualified to serve as a director or coordinator to point up the objectives, the possibilities for waste reduction, the items in a plant that should be checked and the need for managerial assistance to get these things done.

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CONCLUSION

This forum on industrial waste practice pointed up the need for investigation and action by the engineering fraternity to develop a sound professional approach to industrial waste practice by sanitary engineers. There is an obvious need (and opportunity) for specialized service in this field that the sanitary engineer with some additional preparation and the perfection of a cooperative approach is admirably fitted to offer. There is also a need to recognize the professional character of such work, to place it on a high level of competency and professional performance, and to eliminate the element of cost competition in providing such services. To accomplish this, management must be made to appreciate the professional character of the services to be performed, a time-consuming development in which the sanitary engineer must gain the respect of management by his discipline and competence performance.

Recognizing this opportunity the Executive Committee of the Sanitary Engineering Division, with the approval of the Committee on Division Activities, has established a permanent Committee on Industrial Waste Practice.

(Note: As this is a summarized report of the discussion on industrial waste practice, the membership of the Division is urged to comment freely on this subject. Please note the deadline on the cover sheet for discussions.)